

## **KHALIL NAJAFI**

*Professor of Electrical and Computer Engineering*

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### **Research Interests:**

Micromachining and microfabrication technology for mixed-mode (i.e., analog/digital, physical, mechanical, fluidic, chemical) microsystems and MEMS; Micromachined sensors and actuators with applications in power generation, inertial measurement, biomedical devices, microfluidic devices and control, environmental monitoring, and microinstrumentation systems; Analog and digital interface and wireless integrated circuits and microsystems; Biomedical and implantable microsystems and bioMEMS; Micropackaging technologies for integrated and implantable systems; Energy Harvesting and Power Sources for Microsystems.

### **Qualifications and Experience:**

- Sept 2008-2018** *Peter and Evelyn Fuss Chair of Electrical and Computer Engineering Division, and Co-Chair Department of Electrical Engineering & Computer Science, College of Engineering, University of Michigan*
- March 06-** *Schlumberger Professor of Engineering, Endowed Chair, College of Engineering, University of Michigan*
- Jan-Aug 2006** *Visiting Professor, Department of Mechanical Engineering, Swiss Federal institute of technology, ETH, Zurich, Switzerland*
- 1/2004 - 8/2015** *Director, Michigan's National Nanotechnology Infrastructure Network (NNIN), National Science Foundation NNIN Network*
- 9/2000 – 9/2009** *Deputy Director, National Science Foundation Engineering Research Center (ERC) For Wireless Integrated Microsystems (WIMS)*
- 9/1998 – 9/2005** *Director, Solid-State Electronics Laboratory (SSEL), Department of Electrical Engineering and Computer Science; University of Michigan.*
- 9/1998-7/1998** *Professor, Dept. of Electrical Engineering & Computer Science; Univ. of Michigan. Visiting Professor, Physical Electronics Laboratory, Swiss Federal Institute of Technology, ETH, Hoenggerberg, Zurich, Switzerland*
- 7/1998-8/1998** *Visiting Professor, Microelectronics Center, Denmark Technical University, Denmark*
- 9/1993-9/1998** *Associate Professor, Dept. of Electrical Eng. & Computer Science, Univ. of Michigan.*
- 9/1990-9/1993** *Assistant Professor, Dept. of Electrical Eng. & Computer Science, U. of Michigan.*
- 9/1988-9/1990** *Asst. Research Scientist, Center for Integrated Sensors and Circuits, U. of Michigan.*
- 9/1986-9/1988** *Research fellow, Dept. of Electrical Engineering and Computer Science, U. Michigan.*
- 2004-** *Technical Advisory Board, Evigia Systems, Inc., a company that was started by a former student, Dr. Navid Yazdi, specializing in RFID Sensors and Systems*
- 1996** *Co-founder and member of Board of Directors, Integrated Sensing Systems (ISSYS), Inc., a company devoted to the manufacture of integrated microsystems and MEMS.*
- 2007** *Co-founder, and member of Board of Directors, ePack Corp., a company devoted to packaging of MEMS and microsystems*
- 2017** *Co-founder, and member of Board of Directors, Enertia Microsystems, Inc., a company dedicated to commercialization of high-performance inertial sensors,*

### **Education:**

- Ph.D. in August 1986, MSEE in May 1981, and BSEE in May 1980 (summa cum laude) all in Electrical Engineering from the University of Michigan, Ann Arbor, Michigan

### **Professional Service:**

- President, ECE Department Heads Association (ECEDHA), 2016-2017
- Vice President, ECE Department Heads Association (ECEDHA), 2015-2016

- Treasurer/Secretary, ECE Department Heads Association (ECEDHA), 2014-2015
- Regional Chair, Great Lakes Region ECE Department Heads Association, 2009-2014
- Member of the Editorial Board, *IEEE Proceedings*, 2011-2016
- Associate Editor for Smart Sensors, *IOP Journal of Micromechanics & Microengineering*, 1991-2014
- Member of the Editorial Board, *Sensors and Materials Journal*, Published in Japan, 1997-2017
- Member, IEEE Jun-Ichi Nishizawa Medal Selection Committee, 2011-2015 (Chair 2013-2014)
- Associate Editor, *IEEE/ASME Journal of Micro Electro Mechanical Systems (JMEMS)*, 2003-2010
- Member, Editorial Board, *Journal of Biomedical Microdevices*, 1998-2009
- Editor, *IEEE Transactions on Electron Devices*, March 1996-Oct. 2006
- Associate Editor, *IEEE Transactions on Biomedical Engineering*, Sept. 1999-December 2000
- Associate Editor, *IEEE J. Solid-State Circuits*, May 2000-February 2004
- Member, Executive Committee, NSF National Nanotechnology Infrastructure Network 2004-2006, 2010-2012
- General Conference Chair, 2009 *IEEE International Solid-State Sensors and Actuators (Transducers '09) Conference*, Denver, Colorado, USA, June 2009
- Chair, International Steering Committee, *IEEE International Solid-State Sensors and Actuators (Transducers) Conference*, 2007-2009
- Member, International Steering Committee, *IEEE International Solid-State Sensors and Actuators (Transducers) Conference*, June 1997-2011
- Chair, North American Technical Program Committee, *IEEE 2001 International Solid-State Sensors and Actuators (Transducers '01) Conference*, Munich, Germany, June 2001
- Member, Technical Program Committee, 13th *Annual International FES Society Conference (IFESS 2008)*, Freiburg, Germany September 21 – 25 2008
- Co-Chair, *IEEE/ASME Int. Micro Electro Mechanical Systems (MEMS) Conference*, Orlando, 1999
- Chair, Technical Program Committee, *IEEE/ASME int. Micro Electro Mechanical Systems (MEMS) Workshop*, Heidelberg, Germany, 1998
- Member, International Steering Committee, *IEEE International Micro Electro Mechanical Systems Conference (MEMS)*, 1997-2002
- Co-Chair, International Steering Committee, *IEEE International Micro Electro Mechanical Systems Conference (MEMS)*, 2000
- Member, Technical Program Committee, *International Symposium on Low Power Electronics and Devices (ISLPED)*, 2001, 2002, 2003, and 2004
- Member, Program Committee, *IEEE Solid-State Sensors and Actuators Conf. (Transducers '99)*, Sendai, Japan, 1999
- Member, Technical Program Committee, *IEEE Int. Solid-State Circuits Conf. (ISSCC)*, 1998-2003
- Publicity Chairman, 1997 *Ninth IEEE Int. Conf. on Solid-State Sensors and Actuators Conf. (Transducers '01)*, Chicago, USA, 2001
- Member, Program Committee, *Solid-State Sensor and Actuator Workshop*: 1990, 1992, 1994, 1996, 2004
- Member, Technical Program Committee, *IEEE Int. Electron Devices Meeting*: 1993, 1994, 1995
- Member, Technical Program Committee, *IEEE/ASME Micro Electro Mechanical Systems (MEMS) Conference*, 1995-2000
- Member, Technical Program Committee, *The 10<sup>th</sup> Annual Conference of the International Functional Electrical Stimulation Society*, Montréal, Canada, July 2005.
- Member of the Steering Committee, *IEEE International Symposium on Micro Machine and Human Science (MHS '96)*
- Member of the IEEE Electron Devices Society (EDS) Microelectromechanical Systems Technical Committee, Since Fall 1997
- Member, International Advisory Committee, 10<sup>th</sup> International Ceramics Congress and 3<sup>rd</sup> Forum on New Materials, July, 2002, Florence, Italy
- Member, Program Committee, SPIE's 1995 Symposium on Micromachining and Microfabrication, October 23-24, 1995, Austin, Texas.
- Member, Program Committee, SPIE's International Symposium Optics, Imaging, and Instrumentation '96, for the area entitled "Integrated Optics and Microstructures.
- Served as reviewer on numerous government review panels, and different archival journals.

### Awards, Honors, Societies:

- **Ted Kennedy Family Faculty Team Excellence Award**, College of Engineering, University of Michigan, for the Center for Objective Microelectronics and Biomimetic Advanced Technology (COMBAT), ECE, shared with Jack East, Stephen Forrest, Amir Mortazawi, Leland Pierce, Kamal Sarabandi, Dennis Sylvester, Euisik Yoon. 2018.
- **IEEE Daniel E. Noble Technical Field Award**, "For leadership in microsystem technologies and seminal contributions to inertial sensors and hermetic wafer-level packaging," 2015
- **IEEE Sensors Council Technical Field Award**, "For leadership in microsystem technologies and seminal contributions to inertial sensors and hermetic wafer-level packaging," 2013
- **Ted Kennedy Family Team Excellence Award**, College of Engineering, University of Michigan, shared with Professors Michael Flynn, Yogesh Gianchandani, Dennis Sylvester, Ken Wise, Edward T. Zellers 2010 for excellence in Micro Electro Mechanical Systems (MEMS) and Integrated Microsystems, 2010
- Appointed **Schlumberger Professor of Engineering**, College of Engineering, University of Michigan, March 2006
- **Distinguished Faculty Achievement Award**, University of Michigan, for exceptional contributions in scholarship, teaching mentorship and service, 2005
- **Fellow**, American Institute for Medical and Biological Engineering (AIMBE), "In recognition of outstanding contributions to the field of medical and biological engineering," January 2005
- **Outstanding Achievement Award**, EECS Department, Univ. Of Michigan, 2003-2004
- **Faculty Recognition Award**, University of Michigan, 2001
- **Fellow of the IEEE** since January 2000
- Lewis Winner Best Paper Award (with Jeffery Von Arx), Int. Solid-State Circuits Conf., February 1999
- **Arthur F. Thurnau** Professorship for Outstanding Contributions to Undergraduate Teaching, 1999-2002, University of Michigan
- **Research Excellence Award**, College of Engineering, Univ. of Michigan, 1998-1999
- **"Henry Russel Award"** for Outstanding Achievement and Scholarship, 1994-95. This award is given annually to one or two people throughout the University, University of Michigan
- **Teaching Excellence Award**, College of Engineering, University of Michigan, 1994-95
- **"Professor of the Year" Award**, Elected by Students in the Department of Electrical Engineering and Computer Science, and the Eta Kappa Nu Chapter, University of Michigan, Ann Arbor, Michigan, 1993-1994
- **Teaching Excellence Award**, Department of Electrical Engineering and Computer Science, University of Michigan, 1993-1994
- National Science Foundation's "National Young Investigator" Award, 1992-1997
- IEEE Electron Device Society's 1990 Paul Rappaport Award (with K. Suzuki and K.D. Wise) for paper entitled: "A 1024-Element High-Performance Silicon Tactile Imager."
- Best Paper Award for the Int. Electron Devices Meeting (with S.T. Cho & K.D. Wise), Dec. 1992
- Beatrice Winner Award for Editorial Excellence, Int. Solid-State Circuits Conference, Feb. 1986
- Outstanding Graduate Student Achievement Award, Winter 1985
- Outstanding Graduate Student Teaching Assistant Award, Winter 1983
- Edward Harvey Seeley Award for Outstanding Scholarship In the Junior Class, Winter 1978

### Teaching Experience:

I have not had the opportunity to teach since Fall 2008 due to my responsibilities as chair of ECE.

Course #	Level	Course Title	Terms Taught	Enrollment
EECS 211	Sophomore	Electrical Engineering, II ( <i>required for all EEs</i> )	Winter 2000	65
EECS 318	Junior	Analog Electronics	Fall 1990	86
			Fall 1991	78
		( <i>This was a required core EECS course</i> )	Fall 1992	65
			Winter 1993	115
			Fall 1993	70
			Winter 1995	52
			Winter 1996	71
			Winter 1997	100

EECS 413	Senior, 1 <sup>st</sup> Yr. Grad	Monolithic Amplifier Circuits	Fall 1994	26
			Fall 1995	26
			Fall 1996	25
			Fall 1998	40
			Fall 1999	57
EECS 414	Senior, 1 <sup>st</sup> Yr. Grad	Introduction to MEMS	Fall 2001	57
			Fall 2002	66
			Fall 2003	103
			Fall 2004	80
			Fall 2006	107
			Fall 2007	85
EECS 485	Senior, 1 <sup>st</sup> Yr. Grad	Integrated Circuit Fabrication Laboratory	Winter 1990	26
EECS 425	Senior, 1 <sup>st</sup> Yr. Grad	Integrated Microsystems Laboratory	Winter 2007 Winter 2008	49
EECS 514	Grad	Advanced MEMS Devices and Technologies	Winter 2003	31
EECS 522	Grad	Analog Integrated Circuits	Winter 1991	20
			Winter 1992	38
			Winter 1993	20
			Winter 1994	29
EECS 523	Grad	Digital Integrated Circuits	Fall 1989	32
EECS 623	Grad	Integrated Sensors and Sensing Systems	Winter 1999	20
			Fall 2000	33

### **Journal Publications:**

1. K. Najafi, K.D. Wise, T. Mochizuki, "A High-Yield IC-Compatible Multichannel Recording Array," *IEEE Trans. Electron Devices*, Vol. ED-32, No. 7, pp. 1206-1211, July 1985
2. S.L. BeMent, D.J. Anderson, K.D. Wise, K. Najafi, K.L. Drake, "Solid-State Electrodes for Multiplexed Multichannel Intracortical Neuronal Recording," *IEEE Trans. Biomed. Eng.*, Vol. BME-33, No. 2, pp. 230-241, February 1986
3. K. Najafi, K.D. Wise, "An Implantable Multielectrode Array with On-Chip Signal Processing," *IEEE J. Solid-State Ckts.*, Vol. SC-21, No. 6, pp. 1035-1044, December 1986
4. D.J. Anderson, K. Najafi, S.J. Tanghe, D.A. Evans, K.L. Levy, J.F. Hetke, X. Xue, J.J. Zappia, K.D. Wise, "Batch-Fabricated Thin-Film Electrodes for Stimulation of the Central Auditory System," *IEEE Trans. Biomed. Eng.*, Vol. BME-36, No. 7, pp. 693-704, July 1989
5. K. Najafi, K. Suzuki, "Measurement of Fracture Stress, Young's Modulus, and Intrinsic Stress of Heavily Boron-Doped Silicon Microstructures," *J. Thin Solid Films*, 181, pp. 251-258, December 1989
6. S.J. Tanghe, K. Najafi, K.D. Wise, "A Planar IrO Multichannel Stimulating Electrode for Use in Neural Prosthesis," *Sensors and Actuators*, pp. 464-467, B1, 1990
7. J. Ji, K. Najafi, K.D. Wise, "A Scaled Electronically-Configurable Multichannel Recording Array," *Sensors and Actuators*, pp. 589-591, A21-A23, 1990
8. K. Suzuki, K. Najafi, K.D. Wise, "Process Alternatives and Scaling Limits for High-Density Silicon Tactile Imagers," *Sensors and Actuators*, pp. 915-918, A21-A23, 1990
9. K. Najafi, "Integrated Sensors in Biological Environments," Invited Paper, *Sensors and Actuators*, pp. 453-459, B1, 1990
10. J.F. Hetke, K. Najafi, K.D. Wise, "Flexible Miniature Ribbon Cables for Long-Term Connection to Implantable Sensors," *Sensors and Actuators*, pp. 999-1002, A21-A23, 1990
11. K. Najafi, J. Ji, K.D. Wise, "Scaling Limitations of Silicon Multichannel Recording Probes," *IEEE Trans. Biomed. Eng.*, Vol. BME-37, No. 1, pp. 1-11, January 1990
12. K. Najafi, J.F. Hetke, "Strength Characterization of Silicon Microprobes in Neurophysiological Tissues," *IEEE Trans. on Biomedical Engineering*, Vol. BME-37, No. 5, pp. 474-481, May 1990
13. K. Suzuki, K. Najafi, K.D. Wise, "A 1024-Element High-Performance Silicon Tactile Imager," *IEEE Trans. Electron Devices*, Vol. ED-37, No. 8, pp. 1852-1860, August 1990 (Winner of the Paul Rappaport Award for the best paper published in an Electron Device Society publication in 1990)
14. J. Ji, K. Najafi, K.D. Wise, "A Low-Noise Demultiplexing System Active Multichannel Microelectrode Arrays," *IEEE Transactions of Biomedical Engineering*, Vol. 38, #1 January 1991
15. K. Najafi, "Smart Sensors," Invited Paper, *IOP J. Micromech. & Microeng.*, 1, pp. 86-102, June 1991

16. K.D. Wise, K. Najafi, "Microfabrication Techniques for Integrated Sensors and Microsystems," Invited Paper, *Science*, Vol. 254, pp. 1335-1342, November 1991
17. S.T. Cho, K. Najafi, C.L. Lowman, K.D. Wise, "An Ultra-sensitive Silicon Pressure-Based Microflow Sensor," *IEEE Trans. Electron Devices*, Vol. ED-39, No. 4, pp. 825-835, April 1992
18. S.T. Cho, K. Najafi, K.D. Wise, "Internal Stress Compensation and Scaling in Ultra-sensitive Silicon Pressure Sensors," *IEEE Trans. Electron Devices*, Vol. ED-39, No. 4, pp. 836-842, April 1992
19. Y. Gianchandani, K. Najafi, "Batch-Assembled Multi-Level Micromachined Mechanisms from Bulk Silicon," *Journal of Micromechanics and Microengineering*, Vol. 2, No. 2, pp. 80-85, June 1992
20. J. Ji, S.T. Cho, Y. Zhang, K. Najafi, K.D. Wise, "An Ultra-miniature CMOS Pressure Sensor for a Multiplexed Cardiovascular Catheter," *IEEE Trans. on Electron Devices*, Vol. ED-39, No. 10, pp. 2260-2267, October 1992
21. Y. Gianchandani, K. Najafi, "A Bulk Silicon Dissolved Wafer Process for Microelectromechanical Devices," *IEEE/ASME J. Micro Electro Mechanical Systems (J-MEMS)*, Vol. 1, No. 2, pp. 77-85, June 1992
22. R.M. Bradley, R.H. Smoke, T. Akin, K. Najafi, "Functional Regeneration of Glossopharyngeal Nerve Through Micromachined Sieve Electrode Arrays," *Brain Research*, 594, pp. 84-90, 1992
23. S. Bouwstra, J. van Rooijen, H.A.C. Tilmans, A. Selvakumar, and K. Najafi, "Thermal-Base Drive for Micromechanical Resonators Employing Deep-Diffusion Bases," *Sensors and Actuators, A*, 37-38, pp. 38-44, 1993
24. R. Aroca, H. Bolourchi, D. Battisti, and K. Najafi, "Gas Adsorption and Electrical Properties of Two Langmuir-Blodgett Layers of Cerium Bisphthalocyanine," *Langmuir J. American Chemical Society*, 1993
25. J.F. Hetke, J.L. Lund, K. Najafi, K.D. Wise, and D.J. Anderson, "Silicon Ribbon Cables for Chronically Implantable Microelectrode Arrays," *IEEE Trans. on Biomedical Engineering*, Vol. 41, No. 4, pp. 314-321, April 1994
26. T. Akin, K. Najafi, Richard H. Smoke, Robert M. Bradley, "A Micromachined Silicon Sieve Electrode for Nerve Regeneration Applications," *IEEE Trans. Biomedical Engineering*, Vol. 41, No. 4, pp. 305-313, April 1994
27. K. Najafi, "Solid-State Microsensors for Cortical Nerve Recordings," (Invited paper) *IEEE Eng. in Medicine and Biology Magazine*, pp. 375-387, June/July Issue, 1994
28. W.G. Baer, K. Najafi, K.D. Wise, and R.S. Toth, "A 32-Element Micromachined Thermal Imager with On-Chip Multiplexing," *Sensors and Actuators*, Vol. 48, No. 1, pp. 47-54, 1995
29. Y. Gianchandani, and K. Najafi, "Bent-Beam Strain Sensors," *IEEE/ASME J. Micro Electro Mechanical Systems (JMEMS)*, pp. 52-58, Vol. 5, No. 1, March 1996
30. B. Ziaie, J. A. V. Arx, M.R. Dokmeci, and K. Najafi, "A Hermetic Glass-Silicon Micropackage with High-Density On-Chip Feedthroughs for Sensors & Actuators," *IEEE Journal of Microelectromechanical Systems*, Vol. 5, No. 3, pp. 166-179, September 1996
31. J.S. Walter, L. Riedy, W. King, J.S. Wheeler, K. Najafi, C.L. Anderson, T.M. Gudausky, and M. Dokmeci, "Short-Term Bladder-Wall Response to Implantation of Microstimulators," *J. of Spinal Cord Medicine*, Vol. 20, No. 3, pp. 319-323, 1997
32. R.M. Bradley, X. Cao, T. Akin, and K. Najafi, "Long-Term Chronic Recordings From Peripheral Sensory Fibers Using a Sieve Electrode," *J. Neuroscience Methods*, 73, pp. 177-186, 1997
33. B. Ziaie, M.D. Nardin, A.R. Coghlan, and K. Najafi, "A Single-Channel Implantable Microstimulator for Functional Neuromuscular Stimulation," *IEEE Trans. on Biomedical Engineering*, Vol. BME-44, No. 10, October 1997
34. Y. Gianchandani, and K. Najafi, "A Silicon Micromachined Scanning Thermal Profiler with Integrated Elements for Sensing and Actuation," *IEEE Trans. Electron Devices*, Vol. 44, No. 11, pp. 1857-1868, November 1997
35. C. Yeh, and K. Najafi, "A Low-Voltage Tunneling Based Silicon Microaccelerometer," *IEEE Transactions on Electron Devices*, Vol. 44, No. 11, pp. 1875-1882, November 1997
36. J.S. Walter, L. Riedy, W. King, J.S. Wheeler, K. Najafi, C.L. Anderson, T.M. Gudausky, and M. Dokmeci, "Short-Term Bladder-Wall Response to Implantation of Microstimulators," *J. of Spinal Cord Medicine*, Vol. 20, No. 3, pp. 319-323, 1997
37. T. Akin, K. Najafi, and R.M. Bradley, "A Wireless Implantable Multichannel Digital Neural Recording System for a Micromachined Sieve Electrode," *IEEE J. Solid-State Circuits*, January 1998
38. Y. Gianchandani, M. Shinn, and K. Najafi, "Impact of High Thermal Budget Anneals on Polysilicon as a Micromechanical Material," *IEEE/ASME J. Micro Electro Mechanical Systems (JMEMS)*, March 1998
39. C. Yeh, and K. Najafi, "CMOS Interface Circuitry For A Low-Voltage Micromachined Tunneling Accelerometer," *IEEE/ASME J. Micro Electro Mechanical Systems (JMEMS)*, March 1998
40. A. Selvakumar, F. Ayazi, and K. Najafi, "A High Sensitivity Z-Axis Capacitive Silicon Microaccelerometer With A Torsional Suspension," *IEEE/ASME Journal of Microelectromechanical Systems*, Vol. 7, No. 2, June 1998
41. N. Yazdi, F. Ayazi, and K. Najafi, "Micromachined Inertial Sensors," *Invited Paper, Special Issue of IEEE Proceedings*, vol. 86, no. 8, pp. 1640-1659, August 1998

42. A.J. Mason, N. Yazdi, A.V. Chavan, K. Najafi, and K.D. Wise, "A Generic Multi-Element Microsystem For Portable Wireless Applications," *Invited Paper, Special Issue of IEEE Proceedings*, vol. 86, no. 8, pp. 1733-1746, August 1998
43. L. Lin, Y.T. Cheng, and K. Najafi, "Formation of Silicon-Gold Eutectic Bond Using Localized Heating Method," *Japanese Journal of Applied Physics*, Part II, vol. 11B, pp. 1412-1414, Nov. 1998
44. T. Akin, B. Ziaie, S. A. Nikles, and K. Najafi, "A Modular Micromachined High-Density Connector for Implantable Biomedical Systems," *IEEE Transactions on Biomedical Engineering*, vol. 46, no. 4, pp. 471-480, April 1999
45. Y.T. Cheng, Liwei Lin and K. Najafi, "Localized Silicon Fusion and Eutectic Bonding for MEMS Fabrication and Packaging," *IEEE/ASME Journal of Microelectromechanical Systems*, Vol. 9, pp. 3-8, March, 2000
46. B. Ziaie, and K. Najafi, "A Generic Micromachined Silicon Platform for High-Performance RF Passive Components," *J. Micromechanics & Microengineering*, vol. 10, No. 3, pp. 365-371, Sept. 2000
47. Y. Gianchandani, H. Kim, M. Shinn, B. Ha, B. Lee, K. Najafi, and C.S. Song, "A Fabrication Process for Integrating Polysilicon Microstructures with Post-Processed CMOS Circuits," *J. Micromechanics and Microengineering*, vol. 10, No. 3, pp. 380-386, Sept. 2000
48. F. Ayazi, and K. Najafi, "High Aspect-ratio Combined Poly and Single-Crystal (HARPSS) MEMS Technology," *IEEE J. Micro Electro Mechanical Systems*, vol. 9, No. 3, pp. 288-294, Sept. 2000
49. F. Ayazi, and K. Najafi, "High Aspect-Ratio Polysilicon Micromachining Technology," *Sensors and Actuators*, Vol 87, No. 1-2, pp. 46-51, December 2000
50. N. Yazdi, A. Mason, K. Najafi, and K.D. Wise, "A Generic Interface Chip for Capacitive Sensors in Low-Power Multi-Parameter Microsystems," *Sensors & Actuators, A: Physical*, 84 (3) pp. 351-361, 2000
51. N. Yazdi, K. Najafi, "An All-Silicon Single-Wafer Micro-g Accelerometer with a Combined Surface and Bulk Micromachining Process," *IEEE/ASME Journal of Microelectromechanical Systems*, vol. 9, no. 4, December 2000, pp. 1-8.
52. A. Selvakumar, N. Yazdi, K. Najafi, "A Wide-Range Micromachined Threshold Accelerometer Array and Interface Circuit," *Journal of Micromechanics and Microengineering*, vol. 11, No. 2, pp. 118-125, March 2001.
53. B. Ziaie, S.C. Rose, M.D. Nardin, and K. Najafi, "A Self-Oscillating, Detuning-Insensitive Class-E Transmitter for Implantable Microsystems," *IEEE Transactions on Biomedical Engineering*, Vol. 48, No. 3, pp. 397-399, March 2001
54. B. Amir Parviz and K. Najafi, "A Geometric Etch-stop Technology for Bulk Micromachining," *J. Micromechanics and Microengineering*, 11 No. 3, pp. 277-282, May 2001
55. F. Ayazi, and K. Najafi, "A HARPSS polysilicon Vibrating Ring Gyroscope," *IEEE/ASME J. Micro Electro Mechanical Systems*, vol. 10, no. 2, pp. 169-179, June 2001
56. P. Mohseni, K. Nagarajan, B. Ziaie, K. Najafi, and S.B. Crary, "An Ultra-light Biotelemetry Biotelemetry Backpack for Recording EMG Signals in Moths," *IEEE Transactions on Biomedical Engineering*, Vol. 48, pp. 734-737, June 2001
57. M. Dokmeci and K. Najafi, "A High-Sensitivity Polyimide Capacitive Relative Humidity Sensor For Monitoring Anodically-Bonded Hermetic Micropackages," *IEEE/ASME Journal of Microelectromechanical Systems*, Vol.10, No.2, pp. 197-204, June 2001
58. D.L. Zeale, K.C. Garren, R. Rodriguez, J. Reyes, S. Huang, M. Dokmeci, K. Najafi, "The biocompatibility, positional stability, and potential application of an injectable wireless micromachined microstimulator for reanimation of the paralyzed larynx," *IEEE Trans. On Biomedical Engineering (TBME)*, Vol. 48, No.8, pp. 890-897, August 2001
59. Y.T. Cheng, L. Lin, K. Najafi, "A Hermetic Glass-Silicon Package Formed Using Localized Aluminum/Silicon-Glass Bonding," *IEEE/ASME Journal of Microelectromechanical Systems*, Vol. 10, No. 3, pp. 392-399, September, 2001
60. J. W. Weigold, K. Najafi, and S. W. Pang, "Design and Fabrication of Submicrometer, Single Crystal Si Accelerometer," *IEEE/ASME Journal of Microelectromechanical Systems*, vol. 10, no. 4, pp. 518-524, December 2001
61. C. Huang, K. Najafi, "Fabrication of Ultra-Thin P+ Silicon Microstructures Using Ion-Implantation and Boron Etch-Stop," *IEEE/ASME Journal Of Microelectromechanical Systems (JMEMS)*, Vol. 10, No. 4, pp. 532-537, December 2001
62. B. Ziaie, and K. Najafi, "An Implantable Microsystem for Tonometric Blood Pressure Measurement," *Journal of Biomedical Microdevices*, Vol. 3, pp. 285-292, December 2001.
63. O. Akar, T. Akin, and K. Najafi, "A Wireless Batch Sealed Absolute Capacitive Pressure Sensor," *Sensors and Actuators A: Physical*, 95 (1), pp. 29-38, 2001
64. T. J. Harpster, B. Stark, and K. Najafi, "A Passive Wireless Integrated Humidity Sensor," *Sensors and Actuators A: Physical*, Volume 95, Issues 2-3, pp. 100-107, 1 January 2002



65. T. J. Harpster, S. Hauvespre, M. Dokmeci, and K. Najafi, "A Passive Humidity Monitoring System for *In-Situ* Remote Wireless Testing of Micropackages," *IEEE/ASME J. Micro Electro Mechanical Systems (JMEMS)*, Vol. 11, no. 1, pp. 61-67, February 2002.
66. Y. T. Cheng, W. T. Hsu, L. Lin, C. T. Nguyen, and K. Najafi, "Vacuum Packaging Using Localized Aluminum/Silicon-to-Glass Bonding Using Localized Aluminum/Silicon-to-Glass Bonding", *IEEE/ASME Journal of Microelectromechanical Systems (JMEMS)*, vol. 11, No. 5, pp. 556-565, October 2002
67. C. Huang, C. Christophorou, K. Najafi, A. Naguib and H. Nagib, "An Electrostatic Microactuator System in High Speed Jets," *IEEE/ASME Journal Of Micro Electro Mechanical Systems (JMEMS)*, Vol. 11, No. 3, pp. 222-235, June 2002
68. C. Huang, A. Naguib E. Soupos, and K. Najafi "A Silicon Micromachined Microphone For Fluid Mechanics Research," *Journal of Micromechanics and Microengineering*, Vol. 12, No. 6, pp. 767-774, November 2002
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### **Refereed Conference Publications:**

1. K.D. Wise, K. Najafi, "A Micromachined Integrated Sensor with On-Chip Self-Test Capability," *Invited Paper, Digest, Solid-State Sensors Conf.*, pp. 12-16, Hilton Head, SC, June 1984
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4. K. Najafi, K.D. Wise, "An Implantable Multielectrode Array with On-Chip Signal Processing," *Digest, Int. Solid-State Ckts. Conf.*, pp. 98-99, February 1986 (Beatrice Winner Award for Editorial Excellence)
5. S.L. BeMent, K.L. Drake, D.J. Anderson, K.D. Wise, K. Najafi, "Semiconductor Microprobes-Recording/Biocompatibility Properties," *Invited Paper, IEEE/EMBS Eighth Annual Conf.*, Dallas, pp. 1622-1625, Texas, November 1986
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7. K. Najafi, "Sensor-System Interface: The Influence of On-Chip Electronics," *Digest, Int. Symp. Circuits and Systems*, pp. 233-236, Philadelphia, PA, May 1987

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11. K.D. Wise, N. Najafi, C.L. Johnson, J. Cowles, S. Cho, K. Najafi, "An Integrated VLSI Sensor for Semiconductor Process Control," *Technical Digest, TECHCON '88*, pp. 345-348, Dallas, TX, October 1988 (Best Paper in Session)
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13. K. Najafi, K. Suzuki, "A Novel Technique and Structure for the Measurement of Intrinsic Stress and Young's Modulus of Thin Films," *Digest, IEEE Workshop on Micro Electromechanical Systems*, pp. 96-97, Salt Lake City, UT, February 1989
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15. S.J. Tanghe, K. Najafi, K.D. Wise, "A Planar IrO Multichannel Stimulating Electrode for Use in Neural Prosthesis," *Book of Abstracts, 5th Int. Conf. on Solid-State Sensors and Actuators, Transducers '89*, pp. 297-298, Montreux, Switzerland, June 1989
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382. Behrouz Shiari, Tal Nagourney, Sajal Singh, Jae Yoong Cho, and Khalil Najafi. "Simulation-based approach for fabrication of micro-shell resonators with controllable stiffness and mass distribution." In *2018 IEEE Int. Symposium on Inertial Sensors and Systems (INERTIAL)*, pp. 1-4. IEEE, 2018.
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385. A. Sandoughsaz and K. Najafi, "A high-yield fabrication technology for 3D high density high count penetrating micro-electrode arrays," in *Neural Interface Conference*, Minneapolis, USA, June 2018
386. K. Najafi, "Wireless integrated micro systems (WIMS): Past, present, future," *Invited Plenary Talk, Technical Digest, Hilton Head Solid State Sensors, Actuators, and Microsystems Workshop*, pp. 50-53, Hilton Head, USA, June 2018.
387. A. Sandoughsaz, V. Hetrick, B. Rostami, O. J. Ahmed, K. Najafi, "Massive-scale dense customizable penetrating silicon electrode array for 3D neural recording and stimulation," *Neuroscience 2018*, San Diego, CA, USA, Nov. 2018.
388. F. Asgarian, and K. Najafi, "Frequency Scaling in Time Synchronization for Wireless Sensor Networks," *Proceedings of IEEE 14th International Conference on Distributed Computing in Sensor Systems*, 2018, **Best Poster Award**
389. S. Singh, A. Darvishian, J. Cho, B. Shiari, and K. Najafi, "Resonant Characteristics of Birdbath Shell Resonator in n=3 Wineglass Mode," *Proceedings of the IEEE Sensors Conf.*, pp. 1-4, New Delhi, India, October 2018
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393. A. Darvishia, and K. Najafi. "Analysis and Design of Super-Sensitive Stacked (S 3) Resonators for Low-Noise Pitch/Roll Gyroscopes." In *2019 IEEE International Symposium on Inertial Sensors and Systems (INERTIAL)*, pp. 1-4, 2019. (**Best Paper Award**)
394. A. Darvishian, C. Boyd, S. Singh, J-Y Cho, J-K Woo, G. He, and K. Najafi. "Effect of Electrode Design on Frequency Tuning in Shell Resonators." In *2019 IEEE International Symposium on Inertial Sensors and Systems (INERTIAL)*, pp. 1-4, 2019.
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396. Sajal Singh, Jong-Kwan Woo, Guohong He, Jae Yoong Cho, and Khalil Najafi, "0.0062 °/√hr Angle Random Walk and 0.027 °/hr Bias Instability From a Micro-Shell Resonator Gyroscope With Surface Electrodes," *Proceedings, IEEE Int. MEMS Conference*, pp. 737-740, January 2020
397. Sajal Singh, Jae-Yoong Cho, Jong-Kwan Woo, Ester Bentley and Khalil Najafi, "Shell-in-Shell (SiS): 3D Shell Resonator with 3D Conformal Shell Electrodes," *Proceedings, IEEE Int. Symp. On Inertial Sensors and Systems*, Japan, March 2020
398. Jae Yoong Cho, Sajal Singh, Jong-Kwan Woo, Guohong He, and Khalil Najafi, "0.00016 deg/√hr Angle Random Walk (ARW) and 0.0014 deg/hr Bias Instability (BI) from a 5.2M-Q and 1-cm



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### **Invited Presentations and Publications (some were listed above):**

1. K.D. Wise, K. Najafi, "A Micromachined Integrated Sensor with On-Chip Self-Test Capability," *Invited Paper, Digest, Solid-State Sensors Conf.*, pp. 12-16, Hilton Head, SC, June 1984
2. K. Najafi, K.D. Wise, "An Integrated Multielectrode Microprobe for Intracortical Recording," *Invited Talk, BMES 1985 Annual Meeting*, Los Angeles, April 1985
3. K. Najafi, "Silicon Micromachining: Key to Silicon Integrated Sensors," *Symposium on Sensors and Technology*, Case Western Reserve University, Cleveland, Oh., April 1987
4. K. Najafi, "Solid-State Integrated Sensors and Their Application in Instrumentation and Measurement Systems," *Symp. for Innovation in Measurement Science, Instrument Society of America*, Geneva, New York, August 1987
5. K. Najafi, "Control and Measurement with Integrated Solid-State Sensors," *Fourth Regional Symp., Int. Society for Hybrid Microelectronics*, Dallas, April 11-12, 1988
6. K. Najafi, "Implantable Sensors," *Symp. for Innovation in Measurement Science, Instrument Society of America*, Geneva, New York, August 1988
7. K. Najafi, "Integrated Sensors in Biological Environments," *Invited Paper, Book of Abstracts, 5th Int. Conf. on Solid-State Sensors and Actuators, Transducers '89*, pp. 295-296, Montreux, Switzerland, June 1989
8. K. Najafi, "A Dissolved-Wafer Silicon-On-Insulator Technology and Its Applications to Integrated Sensors and Actuators," *ASME Design Engineering Show and Conference*, Anaheim, CA., September 1990
9. K. Najafi, "Integrated Sensors and Microsystems: Communication Links to a Non-Electronic World," *Invited Talk, Eastern Communications Forum*, an Educational Meeting Conducted by the *National Engineering Consortium*, Rye, New York, May 5, 1992
10. K. Najafi, "Packaging and Interconnect Technologies for Solid-State Microsensors," *Invited Talk, 181st Meeting of the Electrochemical Society*, St. Louis, Missouri, May 19, 1992
11. K. Najafi, "A Review of Solid-State Integrated Microsensors and Their Future Application in Space Systems," *Invited Talk, NASA SATWG Sensors and Software Workshop*, New Orleans, LA, June 1992
12. K. Najafi, "Silicon Integrated Microsensors," *Invited Paper, Proceedings, International Society for Optical Engineering (SPIE) Symposium, OE/FIBERS '92*, Boston, MA, September 1992
13. K. Najafi, "Solid-State Integrated Microsensors," *Invited Paper, 124th Meeting of the Acoustical Society of America*, New Orleans, LA, October 31-November 4, 1992
14. K. Najafi, and C.H. Mastrangelo, "Solid-State Microsensors and Smart Structures," *Invited Paper Proceedings, IEEE Ultrasonics, Ferroelectrics, and Frequency Control Symposium*, Baltimore, Maryland, November 1993
15. M.W. Putty, and K. Najafi, "A Micromachined Vibrating Ring Gyroscope," *Invited Paper, Technical Digest, Solid-State Sensors and Actuators Workshop*, pp. 213-220, Hilton Head, SC, June 1994
16. K. Najafi, "Integrated Sensing Systems in Closed Loop Neural Prosthesis," *Invited Keynote Speaker, European Solid-State Sensors and Actuators Conf., EUROSENSORS*, Toulouse, France, September 1994
17. K. Najafi, "Sensor/Circuit Integration in Biomedical Applications," *Invited Presentation, European NEXUS Workshop on Sensor/Circuit Integration*, Toulouse, France, Sept. 29-30, 1994
18. K. Najafi, "Silicon-Based Electronic Interfaces to Biological Systems," *Invited Speaker at the Workshop on "Bio-Mechatronics" held as part of the 1995 IEEE Int. Conference on Robotics and Automation*, Nagoya, Japan, May 22-27, 1995
19. K. Najafi, "Research in Integrated Sensors and Microsystems at the University of Michigan," *Invited Speaker, Technical Digest of the IEEE Seminar on MEMS, MST and Micromachines*, Tokyo, Japan, October 1995
20. K. Najafi, "Recent Progress in Micromachining Technology and Applications in Implantable Biomedical Systems," *Invited Lecture, Proceedings, Sixth Int. Symp. on Micro Machine and Human Science, MHS '95*, pp. 11-20, Nagoya, Japan, October 1995
21. K. Najafi, "Microinstrumentation Systems for Environmental Monitoring," *Invited Paper, Proceedings, Int. Symp. on Micro Systems, Intelligent Materials and Robots*, pp. 142-145, Sendai, Japan, September 1995
22. K.D. Wise, C.H. Mastrangelo, K. Najafi, and Clark T.C. Nguyen, "Research in Integrated Sensors and Microsystems at the University of Michigan," *Invited Paper, Digest, Sensors Expo, Chicago*, September 1995

23. B. Ziaie and K. Najafi, "Biomedical Microdevices: A Micromachining Approach," *Invited Paper, Proceedings, 1995 International Semiconductor Device Research Symposium*, pp. 401-404, Charlottesville, VA, December 5-8, 1995
24. K. Najafi, "Silicon Micromachining Technologies: Future Needs and Challenges," *Invited Speaker SPIE, Micromachining & Microfabrication Process Technology II Conference*, October 1996
25. K. Najafi, "Integrated Biomedical Microsystems," *Invited Speaker, World Congress on Medical Physics and Biomedical Engineering*, September 14-19, 1997, Nice, France
26. K. Najafi, "Research in Wireless Integrated Micro Systems (WIMS) at University of Michigan," *Invited Talk, Sensors Expo, Invited Talk*, Detroit, Michigan, September 19-21, 2000
27. K. Najafi, "MEMS and Microsystems," *Plenary Presentation, International Semiconductor Device Research Symposium*, Washington DC, December 2001
28. K. Najafi, "Power and Integrated Microsystems," *Plenary Presentation, SPIE International Symposium on Design, Test, Integration, and Packaging of MEMS and MOEMS*, Cannes, France, May 6-8, 2002.
29. K. Wise and K. Najafi, "Fully-Implantable Auditory Prostheses: Restoring Hearing to the Profoundly Deaf," *Invited Paper, 2002 IEEE International Electron Devices Meeting (IEDM)*, pp. 499-502, San Francisco CA, December 2002.
30. K. Najafi, "Micropackaging Technologies for Integrated Microsystems: Applications to MEMS and MOEMS," *Invited Plenary Talk, Proceedings of SPIE's Micromachining and Microfabrication Symposium*, pp. 1-19, San Jose, CA, USA, January 27-29, 2003
31. Khalil Najafi, Junseok Chae, Haluk Kulah and Guohong He, "Micromachined Silicon Accelerometers And Gyroscopes," *Invited Paper, IROS - IEEE International Robotics and Systems Conference*, Las Vegas, October 27-31, 2003
32. K. D. Wise, K. Najafi, R. Sacks, and E. T. Zellers, "A Wireless Integrated Microsystem for Environmental Monitoring," *Invited Technology Directions Paper, Technical Digest, IEEE Int. Solid-State Circuits Conference*, pp. 434-435, San Francisco, CA, Feb. 2004
33. E. T. Zellers, W. H. Steinecker, G. R. Lambertus, M. Agah, C.-J. Lu, H. K. L. Chan, J. A. Potkay, M.C. Oborny, J. M. Nichols, A. Astle, H. S. Kim, M. P. Rowe, J. Kim, L. W. da Silva, J. Zheng, J. J. Whiting, R. D. Sacks, S. W. Pang, M. Kaviany, P. L. Bergstrom, A. J. Matzger, Ç. Kurdak, L. P. Bernal, K. Najafi, K. D. Wise, "A Versatile MEMS Gas Chromatograph For Determinations Of Environmental Vapor Mixtures," *Invited Paper and Talk, Technical Digest, Solid State Sensor, Actuator and Microsystems Workshop (Hilton Head 2004)*, Hilton Head Island, South Carolina, June 2004
34. K. Najafi, "Micromachined Gas Chromatography Microsystem for Complex Gas Analysis," *Invited Plenary Talk, DARPA Microsystems Technologies Office Symposium*, San Jose, CA, March 2007
35. K. Najafi, "Wireless Integrated Microsystems for Environmental Monitoring and Implantable Prostheses," *Plenary Talk, Canadian Workshop on MEMS*, Montreal, Canada, Aug. 13, 2007
36. K. Najafi, "Packaging of Implantable Microsystems," *Invited Paper, IEEE Int. Sensors Conference*, Atlanta, Georgia, October 2007
37. K. Najafi, "Wireless implantable microsystems for neural recording and stimulation," *Invited Paper, 2008 Joint 6th International IEEE Northeast Workshop on Circuits and Systems and TAISA Conference, NEWCAS-TAISA 2008*, pp. iv-iv, Montreal, Canada, June 2008
38. Lynch, J. P., Kamat, K., Li, V. C., Flynn, M. P., Sylvester, D., Najafi, K., Gordon, T., Lepech, M., Emami-Naeini, A., Krimotat, A., Ettouney, M., Alampalli, S., and Ozdemir, T., "Overview of a Cyber-enabled Wireless Monitoring System for the Protection and Management of Critical Infrastructure Systems," *SPIE Smart Structures and Materials*, San Diego, CA, March 2009 (*Invited Paper*)
39. K. Najafi, "Wireless Integrated Microsystems for Neural Prostheses," *Plenary Presentation, 5<sup>th</sup> IEEE International Conference on Nano/Micro Engineered and Molecular Systems*, Xiamen, China, Jan. 2010
40. M.M. Sadeghi, R.L. Peterson and K. Najafi, "Hair-based sensors for micro-autonomous systems," *SPIE Defense, Security + Sensing Conference 8373: Emerging Technologies: Micro- and Nanotechnology Sensors, Systems, and Applications*, Baltimore, MD, April 23-27, 2012. (*invited*)
41. K. Najafi, T. Galchev, E.E. Aktakka, R. L. Peterson, J. McCullagh, "Microsystems for Energy Harvesting," *Invited Paper, 16th International Conference on Solid-State Sensors, Actuators, and Microsystems (IEEE Transducers)*, Beijing China, pp. 1845-1850, June 2011
42. K. Najafi, "Biomimetic Hair Sensors: Utilizing the Third Dimension," *Plenary Talk, IEEE Sensors Conference*, Taipei, Taiwan, 2012
43. K. Najafi, "Wireless integrated micro systems (WIMS): Past, present, future," *Invited Plenary Talk, Technical Digest, Hilton Head Solid State Sensors, Actuators, and Microsystems Workshop*, pp. 50-53, Hilton Head, USA, June 2018.

### **Other Conference or Symposium and Invited Presentations:**

1. K. Najafi, "Organic and Inorganic Coatings for Protection of Integrated Circuit Electrodes," *18th Annual Neural Prosthesis Workshop*, National Institutes of Health, Bethesda, MD., October 28-30, 1987
2. J.F. Hetke, D.J. Anderson, D.A. Evans, J.A. Wiler, K. Najafi, R.A. Altschuler, "Tissue Volume Selectivity in the Cochlear Nucleus to Electrical Stimulation with Multichannel Silicon Substrate Arrays," *Association for Res. in Otolaryngology*, Midwinter Meeting, Florida, February 7, 1989
3. K. Najafi, "Fabrication of Microstructures and Integrated Sensors Using a Dissolved-Wafer Silicon-On-Insulator Process," *General Motors Research Labs Solid-State Sensor Workshop*, February 10, 1989
4. K.D. Wise, K. Najafi, and W.G. Baer, "A Silicon Thermopile-Based Sensor for Non-Contact Thermal Imaging in Industrial process Control," *Temperature Measurement Workshop*, Santa Fe, CA., February 20, 1990
5. J.F. Hetke, D.J. Anderson, J.A. Wiler, K. Najafi, K.D. Wise, "An Implantable Multichannel Silicon-Substrate Array for Chronic Stimulation of the Central Nervous System," *Midwinter Meeting, Association for Research in Otolaryngology*, St. Petersburg, FL., February 1991
6. K. Najafi, "Solid-State Sensor and Actuator Research at the University of Michigan," *Meeting of the Michigan Chapter of the American Vacuum Society*, Ann Arbor, Michigan, February 1991
7. R.M. Bradley, S. Gurkan, B.E. Bradley, K. Najafi, "Regeneration of Rat Glossopharyngeal Nerve Through Sieve Electrodes," *ASChES XIII Conf.*, April 1991
8. K. Najafi, "Solid-State Integrated Sensors, Fundamentals and Applications," *Symposium on Electrochemical Science and Technology of the Michigan Chapter of the Electrochemical Society*, Warren, Michigan, May 1991
9. R.M. Bradley, R.H. Smoke, T.A. Akin, K. Najafi, "Functional Regeneration of Glossopharyngeal Nerve Through Micromachined Sieve Electrodes," *ASChES XIV Conf.*, April 1992
10. K. Najafi, "Present Advances and Future Needs in Integrated Sensors and Microsystems," *National Materials Advisory Board (of the National Research Council) Workshop on Microengineering*, Washington D.C., April 30-May 1, 1992
11. K. Najafi, "Microinstrumentation Cluster for Environmental Sensing," *GE MEMS and Advanced Packaging Workshop*, Schenectady, NY, November 28-29, 1995
12. Muller, M. O., Bernal L.P., Chou, T.-K. A, Najafi, K., and Washabaugh, P. D. 2001 "On Propulsion Efficiency And Vortical Structure Of Synthetic Jet Flows." *APS Division Of Fluid Dynamics 54th Annual Meeting*, San Diego, Ca, November 18-20, 2001.
13. Y. Shimatani, S.A. Nikles, K. Najafi, and R.M. Bradley, "Simultaneous chronic recording from multiple single fibers of the chorda tympani nerve using an implantable sieve electrode array," *Presented at the XXIV annual meeting of the Association for Chemoreception Sciences*, Sarasota FL April 24-28, 2002.
14. P. Mohseni and K. Najafi, "Bi-directional wireless microsystems for biomedical in vivo recording applications," *SIGDA Ph.D. Forum at 40th Design Automation Conf. (DAC'03)*, Anaheim, CA, June 3, 2003.
15. P. Mohseni, and K. Najafi, "Single-Chip Wireless Microsystems for Multichannel Neural Biopotential Recording," *2006 NIH-NINDS Neural Prosthesis Workshop*, Bethesda, Maryland, October 2006
16. K. Najafi, "Micromachined Angular Rate Sensors and Gyroscopes: A historical and Technical Perspective," *WIMS Industrial Advisory Board Meeting*, October 2015
17. K. Najafi, "MEMS Inertial Microsystems, A Historical and Technical Perspective," *Invited Tutorial, IEEE Int. Symposium on Inertial Sensors*, Laguna Beach, February 2016

### **Invited Seminars and Colloquia (since 2004)**

1. K. Najafi, "Review of Center for Wireless Integrated Microsystems," *Honeywell Corporation*, Plymouth, MN, January 2004
2. K. Najafi, "MEMS Sensors For Navigation, Control, and Monitoring For Use With Nano Air Vehicles," *DARPA Nano Air Vehicles (NAV) Workshop*, Washington DC, March 2, 2004
3. K. Najafi, "Research Activities in the Solid-State Electronics Laboratory (SSEL) & Center for Wireless Integrated Microsystems (WIMS)," *Sensor Consortium Meeting*, Ann Arbor, MI, August 19, 2004
4. K. Najafi, "Wireless Integrated Microsystems (WIMS): Monitoring The Environment and Augmenting Biological Functions," *Kyoto University, MICRO Alliance Meeting*, Kyoto, Japan, October 2004
5. K. Najafi, "Biomedical Wireless Implantable Microsystems (BioWIMS)," *Department of Electrical and Computer Engineering, University of Maryland, College Park, Maryland*, February 2005
6. K. Najafi. "Sensor Scaling vs. Performance: A System's Approach, Role of Electronics and Package," *DARPA/MTO Workshop on MEMS/NEMS Basic Science*, Santa Barbara, CA, May 18-19, 2005

7. K. Najafi, "Wireless Integrated Microsystems (WIMS) for Environmental Monitoring and Biomedical Prostheses," *Institute for Microsystems Technologies (IMTEK), University of Freiburg, Freiburg, Germany*, June 17, 2005
8. K. Najafi, "Solid-State Electronics Laboratory (SSEL), Michigan Nanofabrication Facility (MNF), National Nanotechnology Infrastructure Network (NNIN), Center for Wireless Integrated Microsystems (WIMS)," *Ford Motor Company, Dearborn, Michigan*, June 23, 2005
9. K. Najafi, "A High-Flow, High-Pressure Electrostatic Peristaltic Micropump For A Gas Chromatograph," *Institute for Electronics, Microelectronics and Nanotechnology (IEMN), University of Lille, Lille, France*, Nov. 30, 2005
10. K. Najafi, "Introduction to MEMS, An Overview and Summary," *Institute for Electronics, Microelectronics and Nanotechnology (IEMN), University of Lille, Lille, France*, December 12, 2005
11. K. Najafi, "High-Performance Micromachined Angular Rate Sensors-Part I," *Institute for Electronics, Microelectronics and Nanotechnology (IEMN), University of Lille, Lille, France*, December 19, 2005
12. K. Najafi, "High-Performance Micromachined Angular Rate Sensors-Part II," *Institute for Electronics, Microelectronics and Nanotechnology (IEMN), University of Lille, Lille, France*, January 5, 2006
13. K. Najafi, "WIMS, MEMS, NEMS, Nano,...?!", to the Expert Committee of the CNRS, Paris, France, Jan. 9, 2006
14. K. Najafi, "Micro Electro Mechanical Systems (MEMS) and Wireless Microsystems," *Hajj Research Institute, Mecca, Saudi Arabia*, Feb. 7, 2006
15. K. Najafi, "Overview of Center For Wireless Integrated Microsystems (WIMS) at the University of Michigan," *Department of Mechanical Engineering, Swiss Federal Institute of Technology (ETH), Zurich, Switzerland*, Feb. 17, 2006
16. K. Najafi, "Passive Wireless Sensor Readout," *Class Lecture, Electronic Sensor Interfaces, Studies on Micro and Nano Systems, Department of Mechanical Engineering, Swiss Federal Institute of Technology (ETH), Zurich, Switzerland*, April 20, 2006
17. K. Najafi, "A Review of Micromachined Vibratory Angular Rate Sensors (Gyroscopes)," *Institute for Microsystems Technologies (IMTEK), University of Freiburg, Freiburg, Germany*, May 9, 2006
18. K. Najafi, "Packaging and Assembly of Integrated Microsystems," *Institute for Microsystems Technologies (IMTEK), University of Freiburg, Freiburg, Germany*, June 6, 2006
19. K. Najafi, "Circuit Techniques for Implantable Biomedical Microsystems," *Institute for Microsystems Technologies (IMTEK), University of Freiburg, Freiburg, Germany*, June 28, 2006
20. K. Najafi, "Wireless Integrated Microsystems (WIMS), farewell Symposium for Prof. Henry Baltes, *Swiss Federal Institute of Technology (ETH), Zurich, Switzerland*, September 29, 2006
21. K. Najafi, "Micro and Nano Technology at University of Michigan Nanofabrication Facility," *Wayne State University, Detroit, Michigan*, Nov. 2006
22. K. Najafi, "Implantable Microstimulators," *Stryker Corp., Kalamazoo, Michigan*, Nov. 27, 2006
23. K. Najafi, "Biomedical Wireless Implantable Microsystems (BioWIMS)," *University of Waterloo, Waterloo, Canada*, May 25, 2007
24. K. Najafi, "Wireless Integrated Microsystems for Environmental Monitoring and Implantable Prostheses," *Canadian Workshop on MEMS, Montreal, Canada*, Aug. 13, 2007
25. K. Najafi, "Review of Micromachined Gas Pumps," *MicRO Alliance Workshop, Kyoto University, Kyoto*, Oct. 2, 2007
26. K. Najafi, "Wireless Integrated Microsystems (WIMS): Monitoring the Environment," *Textron Defense Systems, Wilmington, MA*, Nov. 9, 2007
27. K. Najafi, "Biomedical Wireless Integrated Microsystems (BioWIMS)," *UCLA Bioengineering Colloquium Series, Bioengineering Department, University of California, Los Angeles*, February 27, 2008
28. K. Najafi, "Review of WIMS Center and Research on Implantable Microsystems," *Greatbatch Inc. Seminar, September 2008*
29. K. Najafi, "Biomedical Wireless Integrated Microsystems (BioWIMS)," *Distinguished Lecture Series, ECE Department, Carnegie Mellon University*, March 24, 2009
30. K. Najafi, Becky Peterson, "Review of Selected Research Topics in MEMS and Microsystems," *Invited Talk, Army Research Lab*, June 2010
31. K. Najafi, "Micro and Nano Sciences and Technologies for Aquatic Sciences," *Aquatic Sciences and Limnological and Oceanography, Puerto Rico*, Feb. 2011
32. K. Najafi, "Micro and Nano Biomimetic Hair Transducers: Utilizing the 3<sup>rd</sup> Dimension," *Invited Seminar, EECS Department, Penn State University*, October 2014
33. K. Najafi, "Interfacing with the Nervous System Through Implantable Microsystems," *Invited Seminar, ECE Department, University of Washington*, June 2014
34. K. Najafi, "Energy Harvesting for Autonomous Sensors in the Automotive Environment," *invited talk, Hutchinson-Ford Tech Event, Grand Rapids, Michigan* June 2, 2016

## **Chapters in Books:**

1. K.D. Wise, K. Najafi, "VLSI Sensors in Medicine," in *VLSI In Medicine*, Norman G. Einspruch and Robert D. Gold, eds., Academic Press, 1988
2. K. Najafi, K.D. Wise, N. Najafi, "Integrated Sensors," chapter in "Semiconductor Sensors," Edited by Simon Sze, John Wiley, 1994
3. K. Najafi, "Sensor and Circuit Integration in Biomedical Applications," in *Silicon Sensors and Circuits: On-Chip Compatibility*, Ed. R.F. Wolffenbuttel, pp. 211-257, Chapman and Hall, 1996
4. K. Najafi, "Micromachined Systems For Neurophysiological Applications," in *Handbook of Microlithography, Micromachining and Microfabrication, Volume II: Micromachining and Microfabrication*, SPIE, 1997
5. G. K. Fedder, J. Chae, H. Kula, K. Najafi, T. Denison, J. Kuang, and S. Lewis, "Monolithically Integrated Inertial Sensors," Chapter in "CMOS MEMS," Edited by H. Baltes, O. Brand, G.K. Fedder, C. Hierold, J.G. Korvink, and O. Tabata, Volume 2 of a series of books entitled "Advanced Micro- and Nanosystems," Publisher: Wiley-VCH, 2005
6. M. Ghovanloo and K. Najafi, (January, 2007) "Towards a button-sized 1024-site wireless cortical microstimulating array," in *Handbook of Neural Engineering*, Ed. M. Akay, Ch. 23, Hoboken: John Wiley & Sons, Inc.
7. H. Kim, K. Najafi, and L.P. Bernal, "Gas Micropumps," chapter in *Comprehensive Microsystems*, edited by Y. Gianchandani, Hans Zappe, and O. Tabata, Elsevier Publishers, 2008
8. K. Najafi, T.J. Harpster, H. Kim, J.S. Mitchell, W.C. Welch III, "Wafer Bonding," chapter in *Comprehensive Microsystems*, edited by Y. Gianchandani, Hans Zappe, and O. Tabata, Elsevier Publishers, 2008

## **Patents:**

1. K.D. Wise, K. Najafi, "Method of Manufacturing Thermopile Infrared Detector," US Patent No. 5,059,543, issued October 22, 1991
2. K.D. Wise, K. Najafi, "Thermopile Infrared Detector With Semiconductor Supporting Rim," US Patent No. 5,100,479A, issued March 31, 1992
3. K. Najafi, K.D. Wise, "Single-Channel Microstimulator," US Patent No. 5,314,458, issued May 24, 1994
4. Navid Yazdi, and K. Najafi, "Microelectromechanical Capacitive Accelerometer and Method of Making Same," US Patent No. 6,035,714, issued on March 14, 2000
5. N. Yazdi, K. Najafi, "Single-Side Microelectromechanical Capacitive Accelerometer and Method of Making Same", US Patent No. 6,167,757, Issued January 2, 2001.
6. Liwei Lin, Yu-Ting Cheng, Khalil Najafi and Kensall D. Wise, "Process for Making Microstructures and Microstructures Made Thereby," US patent, No. 6,232,150, May 15, 2001.
7. N. Yazdi, K. Najafi, and A. Salian, "Single-side Microelectromechanical Capacitive Accelerometer and Method of Making Same," US Patent No. 6,286,369, Issued September 11, 2001
8. N. Yazdi, K. Najafi, "Single-Side Microelectromechanical Capacitive Accelerometer and Method of Making Same", US Patent No. 6,402,968 B1, June 11, 2002
9. Liwei Lin, Yu-Ting Cheng, Khalil Najafi and Kensall Wise, "Microstructures," US Patent No. 6,436,853, Issued August 20, 2002
10. N. Yazdi, K. Najafi, and A. Salian, "Single-side Microelectromechanical Capacitive Accelerometer and Method of Making Same," US Patent No. 6,718,605, Issued April 13, 2004
11. K. Najafi, and T.K. Allen Chou, "Method of Fabricating a Device Having a Desired Non-planar Surface or Profile and Device Produced Thereby," US Patent No. 6,884,732, Issued April 26, 2005
12. Chou; Tsung-Kuan A., Najafi; Khalil, Bernal; Luis P., Washabaugh; Peter D., "Low-temperature patterned wafer bonding with photosensitive benzocyclobutene (BCB) and 3D MEMS (microelectromechanical systems) structure fabrication," US Patent #6,942,750 B2, Issued Sept. 13, 2005
13. Khalil Najafi, and Junseok Chae, "Micromachined Capacitive Lateral Accelerometer Device and Monolithic, Three-Axis Accelerometer Having Same," US Patent # 6,938,484 B2, Issued Sept. 6, 2005
14. Timothy J. Harpster, and Khalil Najafi, "Method of Joining An Insulator Element to a Substrate," US Patent # 6,939,778, B2, Issued Sept. 6, 2005
15. Asli B. Ucock, Khalil Najafi, and Joseph Giachino, "Multi-Substrate Package and Method for Assembling Same," USPTO patent number 6,958,531, Issued Oct. 25, 2005
16. Khalil Najafi and Chunbo Zhang, "Method of Making a Thick Microstructural Oxide Layer," US Patent # 6,962,831, Issued November 8, 2005
17. K. Najafi, H. Kim, L. Bernal, A. Astle, and P. Washabaugh, "Micropump Assembly For A Micro Gas Chromatograph And The Like," USPTO number #7,008,193, Issued March 7, 2006

18. B.H. Stark, and K. Najafi, "Low temperature method for forming a microcavity on a substrate and article having same," USPTO number #7,029,829, Issued April 18, 2006
19. K. Najafi, J. Chae, and J. Giachino, "Method of fabricating a package with substantially vertical feedthroughs for micromachined or MEMS devices," US Patent No. 7,098,117, Issued August 29, 2006
20. H. Kulah, and K. Najafi, "Method and Micro Power Generator for Generating Electrical Power from Low Frequency Vibrational Energy," USPTO number 7,579,757 B2, Issued Aug. 25, 2009
21. Maysam Ghovanloo, and K. Najafi, "Demodulator, chip and method for digitally demodulating an FSK signal," USPTO number, 7,881,409, Issued Feb. 1, 2011
22. K. Najafi; Khalil, Sang-Hyun Lee, Sang Woo Lee, "Environment-resistant module, micropackage and methods of manufacturing same," USPTO number 8,049,326, Issued November 1, 2011
23. K. Najafi, E. Aktakka, and H. Kim, "Method of Making a Thin-Film Device," USPTO number 8,209,857 B2, Issued July 3, 2012
24. K. Najafi, Sang-Hyun Lee, Sangwoo Lee, "Environment-resistant module, micropackage and methods of manufacturing same," USPTO number 8,476,737, Issued July 2, 2013
25. K. Najafi, Sang-Hyun Lee, Sangwoo Lee, "Environment-resistant module, micropackage and methods of manufacturing same," USPTO number 8,698,292 B2, Issued April 15, 2014
26. T. Galchev, K. Najafi, and Hanseup Kim, "Increased Frequency Power Generation Using Low-Frequency Ambient Vibrations," USPTO Patent Number: 8,796,907 Issued August 5, 2014
27. K. Najafi, D. Egert, "Probes Having Deployable Sites And Methods For Making The Same," USPTO Patent Number: 9,265,465, Issued February 23, 2016
28. Najafi, Khalil, Mahdi Sadeghi, and Rebecca L. Peterson. "Fluid flow sensor." U.S. Patent No. 9,400,197. Issued 26 Jul. 2016
29. K. Najafi, Jae Yoong Cho, "Gyroscope and Method of Fabricating a Resonator for a Gyroscope," USPTO Patent Number 9,494,425 B2, Issued November 15, 2016
30. Khalil Najafi, Mahdi Sadeghi, Rebecca L. Peterson, "Micro-hydraulic Device," US-9,502,995-B2, Issued November 22, 2016
31. Khalil Najafi, Rebecca L. Peterson, Jae Yoong Cho, Zongliang Cao, Guohong He, Jeffrey Gregory, Yi Yuan, "Microsystem device and methods for fabricating the same," US-9,778,039-B2, Issued 10/3/17
32. K. Najafi, JY Cho, Tal Nagourney, "Three dimensional microstructures and fabrication process," US Patent US-9,796,586-B2, Issued Oct. 24, 2017
33. K. Najafi, Erkan Aktakka, "Actuation and sensing platform for sensor calibration and vibration isolation," US Patent No. 9,874,459, Issued Jan. 23, 2018
34. K. Najafi, R.L. Peterson, J. McCullagh, "Full-Wave Charge Pump with Low-Voltage Startup," US Patent No. 10,250,235 B2, Issued April 2, 2019
35. K. Najafi, E. Aktakka, "Multi-Axis Piezoelectric Transducer", US Patent 10,263,173 B2, Issued Apr. 16, 2019
36. K. Najafi, S-H. Lee, S-W Lee, J.S. Mitchell, O. Srivannavit, "Environment-resistant module, micropackage and methods of manufacturing same," US Patent 10,266,392, Issued April 23, 2019
37. K. Najafi, and Y. Tang, "High aspect-ratio low noise multi-axis accelerometers," US Patent No. 10,495,663, Issued December 3, 2019
38. K. Najafi, Yemin Tang, "Capacitive-based Transducer with High-Aspect Ratio," US Patent 10,524,059, Issued December 31, 2019
39. K. Najafi, J-Y Cho, A. Darvishian, G. He, B. Shiari, T. Nagourney, "Gyroscope and Fabrication Process," US Patent 10,532,943, Issued January 14, 2020
40. K. Najafi, Luis Bernal, S.A. Sandoughsaz, A. Besharatian, "Modular stacked variable-compression micropump and method of making same," US Patent 10,563,642, Issued February 18, 2020
41. K. Najafi, A. Darvishian, "Stacked Balanced Resonators," US Patent 10,598,491, Issued March 24, 2020
42. K. Najafi, and J.Y. Cho, "Assembly processes for three-dimensional microstructures," US Patent No. 10,612,925, issued April 7, 2020

### **Post-Doctoral Researchers and Visitors:**

1. Dr. Babak Ziaie, Now professor at Purdue University
2. Dr. Tayfun Akin, now professor at Middle-East Technical University
3. Dr. Yogesh Gianchandani, now professor at University of Michigan
4. Dr. Jong-Uk Bu, January 1995-June 1996, Lucky Goldstar
5. Ms. Meenam Sheen, Samsung Advanced Institute of Technology (SAIT)
6. Mr. E. Kim, Samsung Advanced Institute of Technology (SAIT)
7. Dr. Cimoo Song, Samsung Advanced Institute of Technology (SAIT)
8. Dr. Yuhei Mei, 2000-2001
9. Prof. Hassan Roientan, March 2001-December 2004

10. Dr. Guohong He 1999-2001, and 2011-present
11. Dr. Haluk Kulah 2003-2004
12. Dr. Jun Chae, January 2004-August 2005
13. Dr. Amir Sodagar, March 2001-March 2002, and October 2004-October 2006
14. Dr. Sangwoo Lee, September 2005-2012
15. Prof. Massood Atashbar, Western Michigan University, Sept., 2007-2008
16. Dr. Jay S. Mitchell, February 2008-2010
17. Dr. Sanghyun Lee, February 2009
18. Dr. Reza Azadegan, April 2009-Sept. 2014
19. Dr. Tzeno Galchev, December 2010-October 2011
20. Dr. Guohong He, June 2011-
21. Dr. Zongliang Cao, October 2011-October 2013
22. Dr. Behrouz Shiari, since 2009
23. Dr. Erkan Aktakka, November 2011-September 2018
24. Dr. Jae Yoong Cho, March 2012-
25. Dr. Jong-Kwan Woo, Dec. 2011-
26. Dr. Becky Peterson (assistant Research Scientist), Fall 2009-2013
27. Dr. Iman Shahosseini, October 2012-May 2015
28. Mr. Takuya Nishino, May 2013-2014, Visitor from Fujitsu Labs
29. Dr. Mahdi Sadeghi, January 2014-January 2016
30. Dr. Daniel Egert, May 2015-April 2017
31. Dr. Adrian Zurbuchen, July 2016 to December 2017
32. Mr. Katsuaki Goto, visiting from DENSO International America, Inc., October 2017-April 2019

### **Ph.D. Students Supervised:**

1. Prof. Babak Ziaie, Thesis Title: "A Single-Channel Microstimulator for Functional Neuromuscular Stimulation." Graduation Date: March 1994, Current Position: Professor, Purdue University.
2. Dr. Karl J. Ma, Thesis title: "An Active Dissolved Wafer Process for The Fabrication of Integrated Sensors." Graduation Date: August 1994, Current Position: Employed in a Venture Capital Firm after obtaining his MBA following his Ph.D.;
3. Prof. Tayfun Akin, Thesis Title: "An Integrated Telemetric Multichannel Sieve Electrode Array for Nerve Regeneration Applications." Graduation Date: October 1994; Current Position: Professor, Department of Electrical and Electronics Engineering, Middle East Technical University, Ankara, Turkey.
4. Prof. Yogesh Gianchandani, Thesis Title: "A Bulk Silicon Microelectromechanical System for Scanning Thermal Profilometry." Graduation Date: October 1994. Current Position: Professor, Dept. of Electrical and Computer Engineering, University of Michigan, Ann Arbor
5. Dr. Michael Putty, Thesis Title: "A Micromachined Vibrating Ring Gyroscope." Graduation Date: March 1995. Current Position: Senior Research Scientist, ISSYS, Ypsilanti, Michigan;
6. Dr. Mark Nardin, Thesis title: "A Programmable Multichannel Microstimulator with Bi-Directional Telemetry." Graduation Date: January 1996. Current Position: Research Staff, Intel Corporation;
7. Dr. Chingwen Yeh, Thesis Title: "A Dissolved-Wafer Tunneling Based Silicon Microaccelerometer." Graduation Date: August 1996. Senior IC Design Scientists, Broadcom, CA.
8. Dr. Arjun Selvakumar, Thesis Title: "A Multifunctional Silicon Micromachining Technology for MEMS Applications." Graduation Date: April 1997. Current Position: Senior VP Science and Technology, INOVA Technologies, Houston, Texas
9. Dr. Jeffrey Von Arx, Thesis Title: "A Single-Chip Fully Integrated Telemetry-Powered System for Peripheral Nerve Stimulation." Graduation Date: March 1998. Current Position: Research Manager, Guidant Corporation, Minneapolis, MN
10. Dr. Navid Yazdi, Thesis Title: "Micro-g Silicon Accelerometers with High-Performance CMOS Interface Circuitry." Graduation Date: February 1999. Current Position: CEO and President, Evigia Systems, Inc., Ann Arbor, Michigan
11. Dr. C.C. Huang, Graduation Date: August 1998. Thesis Title: "Micromachined Sensors and Actuators For Fluid Mechanics research and High-Speed Flow Control Applications," Current Position: Research Staff, TDK Invensense Corp.
12. Dr. Mehmet Dokmeci, Graduation Date: December 1999. Thesis Title: "Hermetic Glass-Silicon Micropackages and Feedthroughs for Neural Prostheses." Current Position: Associate Adjunct Professor, UCLA



13. Dr. Farrokh Ayazi, Graduated January 2000. Thesis Title: "A High-Aspect Ratio, High-Performance Polysilicon Vibrating Ring Gyroscope." Current Position: Professor, Georgia Institute of Technology, Atlanta, GA
14. Dr. Y.T. Cheng, Graduation Date: December 2000, Thesis Title: "Localized Heating and Bonding for MEMS Packaging." Current Position: Professor, National Chiao-Tung University (NCTU), Taiwan
15. Dr. Babak Amirparviz, Graduation Date: Feb. 2001, Thesis Title: "Electrostatic Ultrasonic Microjet Propulsion Microsystem." Current Position: VP, Amazon, Seattle, Washington
16. Dr. Arvind Salian, Graduation Date: December 2001, Thesis Title: "Fabrication and testing of All-Silicon Micromachined Micro-g Accelerometer." Current Position: Engineering Manager, Medtronic, Phenix, Arizona
17. Dr. T.K. Allen Chou, Graduation Date: December 2001, Thesis title: "All-Silicon Micromachined Acoustic Ejector Array for Micro Propulsion and Flow Control," CTO, Tricorntech, Taipei, Taiwan
18. Dr. Haluk Kulah, Graduation Date: January 2003, Thesis Title: "Closed-Loop Electromechanical Sigma-Delta Microgravity Accelerometers," Current Position: Associate Professor, Middle East Technical University, Ankara, Turkey, Since Fall 2004
19. Dr. Junseok Chae, Graduation Date: January 2003, Thesis Title: "High-Sensitivity, Low-Noise Multi-Axis Micro-g Capacitive Microaccelerometers," Current Position: Professor, Arizona State University, Arizona
20. Dr. Chunbo Zhang, Graduation Date: October 2003, Thesis Title: "Combustion-Based Micro Power Generation: Thermoelectric and Thermionic Approaches," Research Engineer, NOC
21. Dr. Hao Yu, Graduation Date: January 2004, Thesis Title: "A Wireless Microsystem For Multi-channel Neural Recording Microprobes," Currently With a Circuit Design Company in CA
22. Dr. Brian Stark, Graduation Date: March 2004, Thesis Title: "Thin Film Technologies For Hermetic And Vacuum Packaging Of MEMS," Current Position: Product Manager at Google Corp.
23. Dr. Gary O'Brien, Graduation Date: April 5, 2004, thesis Title: "MEMS Angular rate and Angular Acceleration Sensors With CMOS Switched Capacitor Signal Conditioning," Current Position: Consultant
24. Dr. Maysam Ghovanloo, Graduation Date: August 2004, thesis Title: "A Wireless Microsystem For Neural Stimulating Microprobes," Current Position: Professor, Georgia Institute of Technology
25. Dr. Pedram Mohseni, Graduation Date: August 2005, thesis Title: Single-Chip Wireless Microsystems For Multichannel Neural Biopotential Recording, Current Position: Associate Professor, Case Western Reserve University, Since Sept. 2005
26. Dr. Stefan A. Nikles, Graduation Date: August 2005, thesis Title: A Micromachined Sieve Electrode For Chronic Recording From Multiple, Isolated Gustatory Nerve Fibers, Current Position, Product Engineer, Analog Devices, Inc., Boston, MA
27. Dr. Timothy J. Harpster, Graduation Date: October 2005, Thesis Title: Hermetic Packaging and Bonding Technologies," President, Intek Corp., Ohio
28. Dr. Hanseup Kim, Graduation Date March 30, 2006, Thesis Title: An Integrated Electrostatic Peristaltic Micro Gas Pump With Active Microvalves, Currently: Associate Professor, University of Utah
29. Dr. Asli Burcu Ucok, Graduation Date: March 30, 2006, Thesis Title: Compact Modular Assembly and Packaging Of Multi-Substrate Microsystems (WIMS Cube), Currently Research Engineer at Apple Corp., CA, USA
30. Dr. Jay S. Mitchell, Graduation Date: December 2007, Thesis Title: "Wafer Level Vacuum Packaging Using Au-Si Eutectic," Current Position: CEO and Co-Founder, ePack Inc., Startup Company in Ann Arbor, Michigan
31. Dr. Warren. C. Welch, III, Graduation Date: December 2007, Thesis Title: Wafer-Level Vacuum/Hermetic Packaging Of Mems Using Solder, Research Engineer, CTO at Avegant Corp.
32. Dr. Sang-Hyun Lee, Graduation Date: December 2008, Thesis Title: Wafer-Level Packaging For Environment-Resistant Microinstruments, Current Position: Senior Director, Amkor Technologies, South Korea
33. Dr. Sang Won Yoon, Graduation Date: December 2008, Thesis Title: Vibration Isolation And Shock Protection For MEMS, Current Position: Assistant Professor, Department of Automotive Engineering, Hanyang University, South Korea
34. Dr. Andrew Gross, Graduation Date: December 2010, Thesis Title: Low Power, Integrated, Thermoelectric Micro-coolers for Microsystems Applications, Current Position: Research Engineer, Avegant Corp.
35. Dr. Tzeno Gachev, Graduation Date: December 2010, Thesis Title: Energy Scavenging From Low Frequency Vibrations, Current Position: Research Manager, Analog Devices, Inc.
36. Dr. E. Erkan Aktakka, Graduation Date: December 2011, Thesis Title: Integration Of Bulk Piezoelectric Materials Into Microsystems, Currently: Founder of a New Startup
37. Dr. Amir Borna, Graduation Date: January 2012, Thesis Title: A Low Power Wireless Multichannel Microsystem For Reliable Neural Recording, Current Position: Research Fellow, Sandia National Lab

38. Dr. Jae Yoong Cho, Graduation Date: February 2012, Thesis Title: High-Performance Micromachined Vibratory Rate- And Rate- Integrating Gyroscopes, Current Position: CEO and President: Enertia Microsystems, and also part-time appointment as Research Scientist, U. Michigan
39. Dr. Niloufar Ghafouri, Graduation Date: May 2012, Thesis Title: Bismuth Telluride and Antimony Telluride Based Co-evaporated Thermoelectric Thin Films: Technology, Characterization, and Optimization, Current Position: Sr. Product Engineer at Medtronic, Phoenix Arizona
40. Dr. Jeffrey Gregory, Graduation Date: June 2012, Thesis Title: Characterization, Control and Compensation of MEMS Rate and Rate-Integrating Gyroscopes, Current Position: Research Staff at Analog Devices Inc., Boston Mass.
41. Dr. Ali Besharatian, Graduation Date: May 2013, Thesis Title: A Scalable, Modular, Multi-Stage, Peristaltic Electrostatic Gas Micropump, Current Position: Senior Technical Program Manager, IMT Foundry, Santa Barbara, CA
42. Dr. Seow Yuen Yee, Graduation Date: September 2013, Thesis Title: Design and Development of An ultrasonic Jet Array (UJA) for Micro Propulsion, Position: Senior Research Engineer, Robert Bosch Corp., CA.
43. Dr. Mahdi Sadeghi, Graduation Date: December 2013, Thesis Title: Electrostatic Micro-Hydraulic Hair Sensors and Actuators, Current Position: CEO, Tacit Motion, Boston, MA
44. Dr. James McCallaugh, Graduation Date: January 2014, Thesis Title: Charge Pump Power Conversion Circuits for Low Power, Low Voltage and Non-Periodic Vibration Harvester Outputs, Current Position: Research Fellow, Dept. Civil & Environmental Engineering, Univ. of Michigan
45. Dr. Daniel Egert, Graduation Date: April 2015, Thesis Title: Intracortical neural probes with post-implant self-deployed electrodes for improved chronic stability, Current Position: Post-Doctoral Researcher at UCSF Medical Center
46. Dr. Stacey Tang, Graduation date: December 2017, Thesis Title: High Aspect-ratio Biomimetic Hair-like Microstructure Arrays for MEMS Multi-Transducer Platform," Current Position: Research Engineer, Intel Corp., Portland, Oregon
47. Dr. Tal Nagourney, Graduation Date: April 2018, Thesis Title: High-Q Fused Silica Micro-Shell Resonators for Navigation-Grade MEMS Gyroscopes, Current Position: Staff Consultant, Engineering Systems Inc. (ESI), Seattle, Washington
48. Dr. Ali Darvishian, Graduation Date: August 2018, Thesis Title: Design and Analysis of Extremely Low-Noise MEMS Gyroscopes for Navigation, Current Position: Post-Doctoral Researcher, University of California at Berkeley
49. Dr. Amin Sandoughsaz, Graduation Date: December 2018, Thesis Title: Sea of Electrodes Array (SEA): Customizable 3D High-Density High-Count Neural Probe Array Technology, Current Position: Research Engineer, Knowles Inc.
50. Dr. Donguk (Max) Yang, Graduation Date: May 2019, Thesis Title: Oven-Controlled Inertial Sensors, Current Position: Research Engineer, NASA Glenn Research Center
51. Dr. Yuan Yi, Graduation Date: March 2019, Thesis Title: Vertical Self-Defined Thermoelectric Legs for Use in Thin-Film  $\mu$ TEGs, Current Position: Research Engineer, Analog Devices, Inc., Boston

### **Membership in Ph.D. Committees:**

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25. Mr. Mark Richardson
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27. Mr. Mike Pinelis
28. Mr. Urs Frey, Thesis Defense: October 10, 2007, Swiss Federal Institute of Technology, Title: "High-Density Neural Interface and Microhotplate Gas Sensor in CMOS Technology," Advisor: Prof. A. Hierlemann
29. Mr. Sheng-Shian Lee, thesis Defense: February 23, 2007, Advisor: Prof. C.T.N. Nguyen
30. Mr. Yu-wei Lin, EECS, Thesis Defense: December 14, 2006, Advisor: Prof. C.T.N. Nguyen
31. Ms. Helena Chen, EECS, Thesis Defense, October 13, 2006, Advisor: Prof. K. Wise
32. Mr. Seung Bae Lee, EECS, Thesis Defense: September 25, 2006, Advisor: Prof. C.T.N. Nguyen
33. Mr. Andre Taylor, Chemical Eng., Thesis Defense, Feb. 11, 2005, Advisor: Prof. Levi Thompson
34. Mr. Yu-Chung Tung, Mechanical Eng., Thesis Defense, April 4, 2005, Advisor: Prof. K. Kurabayashi
35. Mr. Fatih Kocer, EECS, Thesis Defense, April 14, 2005, Advisor: Prof. Michael Flynn
36. Mr. Kenichi Takahata, EECS, Thesis Defense: April 21, 2005, Advisor: Prof. Y. Gianchandani
37. Mr. David Lemmerhirt, EECS, Thesis Defense: April 28, 2005, Advisor: Prof. K. Wise
38. Mr. Mustafa Demirci, EECS, Thesis Defense, June 21, 2005, Advisor: Prof. C.T.N. Nguyen
39. Mr. Massoud Agah, EECS, Thesis Defense: July 25, 2005, Advisor: Prof. K. Wise
40. Ms. Ying Yao, EECS, Thesis Defense, Aug. 5, 2005, Advisor: Prof. K. Wise
41. Mr. Nelson Sepulveda, ECE, Michigan State University, Thesis Defense, Dec. 8, 2005, Advisor: Prof. Dean Aslam, Michigan State Univ.
42. Mr. Li Ding, Electrical Engineering and Computer Science, Feb. 4, 2004, Advisor: Prof. P. Mazumder
43. Mr. Keith Kraver, Electrical Engineering and Computer Science, Feb 9, 2004, Title: Low Voltage and Low Power Deep Submicron Analog Circuits for Single Chip Mixed-Signal Microinstrumentation Systems, Thesis Advisor: Prof. Richard Brown
44. Mr. Steven Raasch, Electrical Engineering and Computer Science, March 26, 2004, Title: A Scalable Instruction Queue Design for Exploiting Parallelism, Advisor: Prof. Steven K. Reinhardt
45. Mr. Michael McCorquodale, Electrical Engineering and Computer Science, April 9, 2004, Title: Monolithic and Top-Down Clock Synthesis With Micromachined Radio Frequency Reference, Advisor: Prof. Richard Brown
46. Mr. Andrew DeHennis, Electrical Engineering and Computer Science, April 16, 2004, Title: Remotely Powered Wireless monitoring Systems, Advisor: Prof. Ken Wise
47. Mr. Timothy Strong, Electrical Engineering and Computer Science, April 28, 2004, Title: Microfabricated Voltammetric Neuro Arrays For Use In Vitro, Advisor: Prof. Richard Brown
48. Mr. Roy Olsson, Electrical Engineering and Computer Science, June 15, 2004, Title: Silicon Recording Arrays with Integrated Circuitry For In-Vivo Neural Data Compression, Advisor: Prof. Ken Wise
49. Mr. Steven M. Martin, Electrical Engineering and Computer Science, October 21, 2004, Title: CMOS Integrated Liquid Chemical Microdetection Systems, Advisor: Prof. Richard Brown
50. Mr. Hamed Khalkhali, Electrical Engineering and Computer Science, November 1, 2004, Title: Modeling and Design of Compact Thermosyphons for Electronic Cooling, Advisor: Prof. Katsuo Kurabayashi (ME)
51. Mr. Fadi Gebara, Electrical Eng. and Computer Science, November 15, 2004, Advisor: Prof. R. Brown
52. Mr. Robert Hower, Electrical Eng. & Computer Science, November 15, 2004, Advisor: Prof. R. Brown
53. Ms. Kim Cook, Mechanical Engineering, December 16, 2004, Advisor: Prof. A.M. Sastry (ME)
54. Mr. Brian Jamieson, Biomedical Eng., Advisor: Prof. Ken Wise, Dissertation Defense: January 14, 2003
55. Mr. John Clark, Electrical Engineering and Computer Science, Advisor: C. Nguyen, Dissertation Defense, May 20, 2003
56. Mr. Alex Margomenos, Electrical Engineering and Computer Science, Advisor: L. Katehi, July 9, 2003
57. Mr. Sergio Pacheco, Electrical Eng. and Computer Science, Advisor: Linda Katehi, August 29, 2003
58. Mr. Diego Barterrimo, Advisor: Prof. Henry Baltes, Physics, ETH, Switzerland, Graduated January, 2004
59. Mr. Michael Muller, Aerospace Engineering, University of Michigan, Graduated: April 24, 2002, Advisor: Prof. Luis Bernal
60. Ms. Patty Chang-Chien, Electrical Engineering and Computer Science, University of Michigan, Advisor: Prof. Ken Wise, Graduated: February 22, 2002
61. Dr. Edwin Carlen, Electrical Engineering and Computer Science, University of Michigan, Advisor: Prof. Carlos Mastrangelo, Graduated March 23, 2001

62. Dr. Jason Weigold, Electrical Engineering and Computer Science, University of Michigan, Advisor: Prof. Stella Pang, Graduated June 2000
63. Dr. Andrew Mason, Electrical Engineering and Computer Science, University of Michigan, Advisor: Prof. Ken Wise, Graduated August 2000
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65. Dr. Uk-Song Kang, Electrical Engineering and Computer Science, University of Michigan, Advisor: Prof. Ken Wise, Graduated June 1999
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67. Dr. Kun Wang, Electrical Engineering and Computer Science, University of Michigan, Advisor: Prof. Clark Nguyen, Graduated October 1999
68. Dr. Jinsoo Kim, Electrical Engineering and Computer Science, University of Michigan, Advisor: Prof. Ken Wise, Graduated 1999
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70. Dr. Felix Mayer, Institute of Physics, Federal Institute of Technology (ETH), Zurich, Switzerland, Advisor: Prof. Henry Baltes, Graduated May 1998
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72. Dr. Jasper Bay, Microelectronics Center, Technical University of Denmark, Advisor: Prof. Siebe Bouwstra, Graduated August 1998
73. Dr. Jeff Siegle, Department of Applied Physics, University of Michigan, Graduated 1997
74. Dr. Steve Richardson, Electrical Engineering and Computer Science, University of Michigan, Advisor: Prof. Linda Katehi, Graduated 1997
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90. Dr. Steven T. Cho, Electrical Engineering and Computer Science, University of Michigan, Advisor: Prof. Ken Wise, Graduated 1991
91. Dr. Euisik Yoon, Electrical Engineering and Computer Science, University of Michigan, Advisor: Prof. Ken Wise, Graduated 1990
92. Dr. Jin Ji, Electrical Engineering and Computer Science, University of Michigan, Advisor: Prof. Ken Wise, Graduated 1990